

SECTION 401 PLANT MIX PAVEMENT

401.01 DESCRIPTION. This work is the production and placing of plant mix asphalt pavements.

Plant mix pavement is one or more courses of plant mixed aggregate, mineral filler or chemical additive when required, and bituminous material, constructed on a prepared foundation.

401.02 MATERIALS.

401.02.1 Aggregate. Use aggregate sources meeting Section 106 requirements. Produce aggregate meeting Section 701 requirements.

401.02.2 Bitumen. Furnish bitumen meeting Section 702 and the Contract requirements.

401.02.3 Blending Material. Blending material is selected natural or crushed mineral aggregate.

Do not use pit stripping's, overburden, or other deleterious material as blending material.

Furnish blending material with a volume swell not exceeding 8 percent and not displaying cracking or disintegration when tested under MT-305.

401.02.4 Mineral Filler. Furnish mineral filler meeting Subsection 713.06 requirements.

The mineral filler quantity and type is determined by tests made with mineral fillers in the crushed aggregate for plant mix bituminous material.

401.02.5 Additives.

A. Hydrated Lime. Furnish hydrated lime meeting Subsection 713.02 requirements. Hydrated lime introduced into a paving mixture, in a blend box with asphalt cement, is a chemical additive and is not included in gradation test results.

B. Anti-Stripping Additive. Furnish anti-stripping additives meeting the contract requirements.

The percentage of anti-stripping additive is determined by laboratory tests on samples of the aggregate proposed for use. The anti-stripping additive must be uniformly distributed throughout the bituminous material at the refinery.

The anti-stripping quantity may be increased or decreased by the Engineer.

401.03 CONSTRUCTION REQUIREMENTS.

401.03.1 Composition of Mixtures.

A. Job Mix Formula - Design. Develop and submit for approval, a proposed job mix target aggregate gradation for each grade of pavement mix to be

produced. Establish a single target value for each specified aggregate size within the Job Mix Target Limits in Table 701-15 of Subsection 701.03. The job mix tolerances will be applied to the approved target values. Submit the proposed job mix formula on Form CB-30 QA before submitting the mix design samples.

Furnish aggregate samples, witnessed by the Department, representing total production at least 20 days before mixing operations. The Department will establish for each mixture a design mix formula providing the approved job mix aggregate gradation, a recommended asphalt content, and the types and quantities of additives, if required.

Produce aggregates meeting the approved job mix aggregate gradation. This procedure will be repeated if there is a change in the aggregate properties or a change in the materials source.

- B. Job Mix Formula - Field Established.** A job mix formula for each grade of bituminous mix will be established in the field for each design mix formula.

The Engineer will establish a target asphalt content expressed as a percentage of the total mix weight. The target asphalt content is based on design and field Marshall mix test results. The target asphalt content may be adjusted to improve mix properties as measured by field Marshall tests. Maintain the actual asphalt content in the mix within plus or minus 0.3 % of the target asphalt content.

Use the approved job mix aggregate gradation unless otherwise directed.

- C. Aggregate Sampling and Acceptance.** Aggregate is accepted in the stockpiles for physical properties, excluding combined gradation.

Take samples, witnessed by the Department, for aggregate gradation acceptance testing, just before the bitumen is added to the mix.

When aggregate gradation is controlled by a cold feed control system without plant screens, acceptance testing samples may be taken from the cold feed. Cold feeds for batch plants will not be sampled for acceptance testing when plant screens are used.

401.03.2 Equipment.

- A. All Mixing Plants.** Furnish bituminous mixing plants meeting the following requirements. Scale requirements apply only where proportioning by weight is required. Cold feed control requirements apply only where aggregate gradation is controlled by a cold feed control system.

- 1. General.** Use mixing plants of the weight-batching, continuous-flow, or dryer drum type.

Do not use mixing plants that cannot produce a uniform mix meeting the Contract requirements.

- 2. Storage and Heating Equipment.** Use bitumen storage tanks that uniformly heat and maintain the tank contents at the required temperatures.

Do not allow fuel oil or other material to contaminate the bitumen.

Equip storage tanks with a gauge, calibrated rod, or float that accurately measures the contents.

3. **Aggregate Feeder.** Equip plants with an accurate, mechanical aggregate feed system.
4. **Bins.** Provide easy and safe access to bins and bin sampling areas. Provide separate, dry storage for the mineral filler.
5. **Bituminous Control Unit.** Use weighing or metering devices to control the bituminous material introduced into the mix within the specified limits.

Measure the bitumen discharged into the mixer by a temperature-compensating meter with totalizer.

6. **Thermometric Equipment.** Install an armored thermometer or other approved thermometric device in the bituminous material feed line near the charging valve at the mixer.

Use thermometric equipment having an accuracy of plus or minus 5 °F (3 °C), sensitive to a minimum temperature rate change of 10 °F (5.5 °C) per minute.

7. **Emission Control.** Furnish emission control devices meeting the Department of Health and Environmental Sciences requirements.

Do not discharge wet scrubber effluent into a live stream, lake, or pond. Circulate the effluent through sludge pits or tanks. Contain and dispose of the sedimentation, and all other wastes produced by crushing and mixing operations under Subsection 106.02.5.

Do not return the material collected from air pollution control equipment (bag house fines) to the mix unless authorized in writing. Authorization may be terminated when test results indicate any mix property is outside the specified limits. When authorized, return bag house fines to the mix where the asphalt is introduced, using equipment to meter and uniformly add as a percentage of the total aggregate as established by the Engineer.

8. **Scales For Hauling Units.** Furnish haul unit scales meeting Subsection 301.03.2© requirements.

9. **Plant Scales.** Obtain the Engineer's approval for all weighing equipment. Use adjustable weigh equipment accurate to within 0.5 percent of the true weight throughout the use range.

Have available at least ten 50-pound (22.7 kg) weights for scale testing. Have scales inspected and sealed when requested.

Use beam scales with a telltale indicator for each size aggregate and a tare beam for balancing the hopper. The telltale indicator must begin moving when the weight is within 100 pounds (45.4 kg) of the desired weight. Poises must lock in any position and prevent unauthorized change.

Use vibration-free springless dial scales with dial numerals legible from a distance of at least 10 feet (3 m). The dial must be a compounding type with a full complement of index points and be in plain view of the operator. Pointers causing parallax errors cannot be used.

Replace scales failing to maintain positive adjustment.

10. Weigh System.

- a. **Automatic Weighing.** Plant mix bituminous mixtures may be weighed with an automatic digital weigh system. Assure weigh accuracy to within plus or minus 0.5 percent of the true weight throughout the use range.

Include in the system an automatic printer that provides the following information:

1. Project No. (as shown on plans)
2. Item Name (as shown on detail estimate)
3. Date
4. Time
5. Ticket Number (consecutive)
6. Haul Unit No.
7. Net tons (metric ton) in load (to nearest 0.05 ton)
8. A subtotal of tons (metric tons) for each haul unit since the beginning of the shift.
9. An accumulated total for all haul units since the beginning of the shift.

Use a pre-programmed printer or one equipped to prevent manual override of any weight information. Have the weigh system tested, certified, and sealed by the State Bureau of Weights and Measures after each plant move and before production for a project. Immediately stop production should the printer malfunction or breakdown and do not resume until corrected. Delivery of material from storage or surge bins will be permitted only if the weight can be maintained within weigh specifications.

The Project Manager will randomly designate the re-weighing of loaded vehicles, at least 3 times per project, on a independent certified scale if one is within a 20 mile (32 km) round trip distance from either end of the project.

Re-test the plant weigh system any time the difference between the re-check and the plant system exceeds plus or minus 1½% of the load. Any weight difference will be treated under Subsection 109.01.1.

- b. **Manual Weighing.** The Contractor may manual weigh and record weights instead of using an automatic digital weigh system. Manual weighing must include platform scales as specified in Subsection 301.03.2© and a competent weigh person and dump person.

Direct the weigh person to record, on Department furnished forms, weights to the nearest 100 pounds (45.4 kilograms) as well as other required information regarding delivery and placement.

Tabulate and furnish a machine tape for the total of the weighed material delivered and placed on the roadway each shift. Certify that weights and totals furnished are a true and correct record of materials delivered and placed in the work. Deliver the records and totals to the Project Manager before 10:00 a.m. the next working day following the shift.

The Project Manager will randomly designate the re-weighing of loaded vehicles to verify the recorded weight at least once each day. Weight differences are treated under Subsection 109.01.1. Submit trucks weighing on platform scales for random taring at least twice each day.

11. **Safety Requirements.** Install and maintain stairs, ladders, walkways, and all other plant facilities meeting State and Federal safety requirements.

Provide access to the tops of truck bodies for taking samples and mix temperature data.

Maintain a safe and unobstructed route in and around the truck loading area.

12. **Cold Feed Control.** Aggregate gradation may be controlled by a cold feed control system permitting hot mix plant operation without plant screens, excluding a scalping screen.

Feed each aggregate stockpile through a separate bin having a positive feed that can be accurately calibrated. Use a quick-adjusting feed that maintains a constant, uniform flow throughout its calibration range.

Re-combine the aggregate in the mix design proportions in the cold feed process before it enters the dryer.

Batch and continuous flow plants operating without cold feed controls must have enough bins to store aggregate and permit recombining of the aggregate in the required proportions.

13. **Burner Fuel Restrictions.** Approved fuels to heat and dry aggregates are as follows:

1. Propane
2. Butane
3. Natural Gas
4. Fuel Oil (grades 1 and 2 only)
5. Coal

B. Batching Plant.

1. **Dryer.** Furnish plants having a dryer or dryers that continuously agitate the aggregate while heating and drying.

Equip the dryer with a mercury-actuated thermometer, an electric pyrometer, or other approved thermometric instrument with a dial scale. Locate the thermometer at the dryer discharge chute so it automatically registers the heated aggregate temperature.

Fully enclose the material transfer or conveyance from the dryer to the mixer.

2. **Screens.** Use plant screens that have a storage capacity exceeding the mixing units full capacity.

3. **Bituminous Control.** Assure the bituminous measuring equipment is accurate to within plus or minus 0.3 percent of the true measure.

Equip the plant with a heated, quick-acting, no-drip charging valve located directly over the bituminous material bucket. The bucket must deliver the heated bitumen in a thin, uniform sheet or in multiple streams over the mixing units full width.

4. **Mixer Unit.** Use a mixer capable of producing a uniform mixture within the job-mix tolerances.
Enclose or hood the mixer box to prevent dust loss.
Equip the mixer box with a lock timing device that controls the mixing cycle.
 5. **Aggregate Sampling Device.** Provide a sampling device that will sample dried aggregate when the plant is operated with plant screens.
When cold feed controls are used, provide a sampling device for taking a composite sample at a point just before the aggregate enters the dryer.
Maintain a constant aggregate feed rate when samples are taken.
Split the sampled material to the size specified in MT 202.
- C. Continuous Mixing Plant.**
1. **Aggregate Control.** Assure the cutoff system automatically stops mixing when the minimum bin level is reached. Equip each bin with an overflow to control the top aggregate level.
Equip the plant with bypass gates for collecting individual box test samples for calibrating gate openings.
Provide a platform scale with a 500 pound (227 kg) capacity and containers for weighing test samples.
 2. **Dryer.** Furnish a dryer meeting Subsection 401.03.2(B)(1) requirements.
 3. **Screens.** Furnish screens meeting Subsection 401.03.2(B)(2) requirements.
 4. **Bituminous Control.** Use a rotating, positive-displacement volumetric proportioning bituminous metering pump with nozzles at the mixing unit. The pump operating capacity must be synchronized with the aggregate flow to the mixing unit by a positive, automatic, adjustable interlocking control. Provide equipment for accurately checking the bitumen flow rate into the mix.
 5. **Mixing Unit.** Equip the plant with a continuous mixer to produce a uniform mix within the job-mix tolerances.
The units paddles must be adjustable and reversible to retard the mix flow. Assure the mixer has the manufacturer's plate stating the mixer's net volumetric content at the heights inscribed on a permanent gauge. Provide charts showing the aggregate feed rate per minute for the aggregate being used.
Equip the discharge hopper with dump gates that permit rapid and complete mix discharge.
 6. **Aggregate Sampling Device.** Furnish a aggregate sampling device meeting Subsection 401.03.2(B)(5) requirements.
- D. Dryer Drum Mixing Plant.**
1. **Cold Feed Control.** Furnish a feed control meeting Subsection 401.03.2(A)(12) requirements.
 2. **Calibrated Cold Feed Proportioning.** Calibrate the cold feed to provide full mix gradation control.

3. **Weight Measurement of Aggregate.** Positive weight measurement of the combined cold feed must regulate the feed gate and permit automatic correction for load variations.
4. **Synchronization of Aggregate Feed and Bituminous Material Feed.** Synchronize the bituminous feed control with the total aggregate weight-measurement device to provide a uniform asphalt percentage in the mix. It must automatically compensate for weight variations in the cold feed coupled with the aggregate moisture content.
5. **Aggregate Sampling Device.** Provide a sampling device that will take a composite sample just before the aggregate enters the dryer drum mixer.

Maintain the aggregate feed rate during sampling. Split the sampled material to between 30 (13.6 kg) and 50 pounds (22.7 kg).

6. **Hydrated Lime or Mineral Filler Feed System.** Introduce dry hydrated lime and mineral filler into drum dryer mixing plants just below the asphalt introduction point.

The system must provide positive, accurate material feed and be automatically synchronized to the aggregate feed. The system must indicate the weight entering the mixing unit on a time coordinated basis.

Weigh using an automatic indicating electronic system. The lime or mineral filler may be weighed directly, or the storage container including lime or mineral filler may be weighed.

Provide a continuous digital readout showing the weight or rate of feed in tons (metric tons) per hour. Record the information using a production monitor/recorder system or by a de-cumulating balance ticket printing system. Record the information at minimum five minute intervals or as directed.

Silo or storage container system weights will not be used for acceptance during filling or transfer. Limit filling or transfer periods to 1 hour per 3 hours of plant operation. Record and provide start and finish times for filling or transfer and the total quantity added.

Suspend mixing for erratic feeding or failure to feed hydrated lime or mineral filler to within 20 percent of the job mix formula. Do not resume until corrected or repaired.

7. **Flow Rate Meter.** Measure the asphalt cement discharged into the mixing unit using a flow rate meter with totalizer and temperature compensation.

The totalizer is to record 1,000,000 gallons (3,785,000 L) and be certified to a plus or minus 0.20 percent of the measured quantity.

Use a flow rate meter and totalizer that automatically corrects to a temperature of 60 °F (16 °C) with an operating range of +60 °F (16 °C) to +450 °F (232 °C).

Locate the totalizer readout in the plant control room so it is readily accessible to the inspector.

The flow rate meter must automatically shut off any time asphalt is diverted or stops entering the mixing unit.

Calibrate the flow rate meter and totalizer before the start of the project and as necessary during production. The Project Manager will witness the calibration.

Provide the equipment and assistance for initial and subsequent calibration checks and furnish the Project Manager a copy of all calibration checks.

Use a calibration volume of at least 3,000 gallons (11,355 L). Use weigh scales that have been tested and certified.

Furnish a test report showing the asphalt's specific gravity.

Spot check failure will require re-testing and certification above. The Project Manager will establish the spot check interval.

8. **Production Monitor-Recorder.** Use recording equipment that automatically monitors and records on a time coordinated basis, the aggregate, lime or mineral filler, and asphalt weight entering the mixing unit. The records may be continuous (chart recorder) or digital printout.

Chart recorders must clearly record asphalt content changes of 0.1 percent or more and aggregate feed rate changes of 1.5 percent or more.

Digital printout equipment must record the day's total production at minimum five minute intervals, or the interval directed by the Project Manager.

Digitally display the aggregate and asphalt rates in tons (metric tons) per hour and daily totals. Display lime or mineral filler by tons (metric tons) per hour or on a de-cumulating balance.

The monitor system must operate on unprocessed signals from measuring devices.

Provide the Project Manager continuous access to the recorder during production.

Submit the permanent record to the Project Manager daily.

Failure to maintain asphalt content within the specified tolerance is grounds to suspend production until corrected. This provision does not apply to the first 15 minutes after each day's first start-up.

Operate the production/monitor recorder at all times during production. Stop production when the recorder is not operational.

E. Storage and Surge Bins.

1. **General.** Hot bituminous mix storage or surge bins may be used for balancing production capacity with hauling and placing capacity.

Discontinue use of hot mix storage or surge bins that cause segregation, adverse mix heat loss, or adversely affects the bituminous mix quality.

Dispose of all rejected mix at Contractor expense.

2. **Low-Level Indicator.** Equip storage or surge bins with an automatic low level indicator that signals when the mix level drops below the discharge cone or the minimum level specified by the manufacturer.

Mix discharge during low level indication is permitted for emptying the bin at the end of shifts.

3. **Loading and Unloading.** Equip storage or surge bins with a batch hopper or rotating chute to reduce segregation during loading. The

batch hopper gates must be interlocked with the mix discharge gates to keep the batch gates closed during mix discharge. Suspend production for equipment failure or improper operation.

4. **Storage Time.** The Project Manager will establish the maximum bin storage time. Initially, a maximum bin storage time of two hours without discharge is permitted until data and experience is available to establish the maximum permissible storage time.

Empty all bins each day at the close of work.

F. Roadway Equipment.

1. **Pavers.** Spread plant mix pavement, shape, and finish using one or more self-contained, self-propelled pavers operated without supplemental spreading, shaping, or finishing equipment to produce the specified work.

Equip pavers with an integral activated screed or strike-off assembly, heated if necessary.

Spread and finish the surfacing course to at least a full lane width and from 3/4 (19 mm) to 6-inches (150 mm) in depth.

Use extension and cut-off shoes in minimum 1 foot (305 mm) increments. Screed extensions must have an equal length of auger extension.

The screed or strike-off assembly must not tear, shove, or gouge the paved surface.

Equip pavers to automatically control the transverse slope and screed elevation using a sensing device at either side of the paver, receiving grade information from an independent grade-line control or the midpoint of a mobile grade reference.

Mount the sensing unit to receive grade information at 15 to 50 percent of the length of the leveling arm ahead of the screed. Furnish a commercially manufactured mobile grade reference recommended by the paver manufacturer.

Use a mobile grade reference device at least 40 feet (12.2 m) long to place the first lane or strip of each plant mix pavement lift. The remaining lanes or strips of each pavement lift may be placed with a mobile grade reference with an effective length of at least 10 feet (3 m), with an adjacent lane or pavement strip as the gradeline reference.

Maintain the transverse slope at all times and have controls to adjust the slope throughout super-elevated curves.

If the automatic controls fail, paving may be finished, not to exceed 4 hours, using manual controls, if the specifications can be met. Repair the automatic controls before starting the next paving shift. Automatic controls may be waived on irregular sections.

Provide an attachment for forming beveled edges on surfacing courses when required.

Pavers must be able to ascend a 7% grade while pushing a loaded truck, have quick, positive steering and operate at speeds commensurate with the mix delivery rate to allow uniform placement and prevent interrupted paver operation.

The plant mix material may be dumped directly into the paver hopper or windrowed ahead of the paver.

The paver hopper capacity must permit the paver to maintain its speed while receiving loads.

2. **Trucks.** Truck haul beds must be tight, clean, smooth and free of cleaning agents before hauling material.

Do not use trucks that cause segregation, delays, or have oil leaks.

When directed, cover each load with canvas or other approved material to protect the mix.

3. **Rollers.** Furnish rollers equipped with drum cleaning devices and a watering system that evenly wets the roller surface.

Do not use steel rollers having flat spots, grooves, or projections that mar or injure the pavement surface.

Remove rollers that crush the paving aggregates.

401.03.3 Aggregate Production, Testing, and Acceptance.

- A. **General.** Furnish aggregates meeting the approved job mix target values within tolerances at the point of bituminizing.

Be responsible for all sampling, testing and controlling aggregate gradations, mechanical fracture, and volume swell during aggregate production. Establish a quality control plan using generally recognized procedures.

- B. **Acceptance Sampling and Testing.** Acceptance sampling will be by Subsection 401.03.1(C).

1. **Mechanical Fracture and Volume Swell.** Mechanical fracture tests will be by MT-217. Volume swell tests will be by MT-305.

2. **Aggregate Gradation.** The Project Manager will randomly select gradation test samples.

The approximate quantity represented by each sample will be 600 tons (540 mt). Additional samples may be selected and tested at the Project Manager's discretion.

The quantity represented by 5 samples or approximately 3000 tons (2700 mt) will constitute a lot whenever production schedules and material continuity permit. The Project Manager may establish a lot quantity represented by 3 to 7 consecutive random samples when there are short production runs, significant material changes, or other unusual characteristics of the work.

Gradation tests will be by MT-202.

- C. **Acceptance.**

1. **Fracture and Volume Swell Requirements.** The aggregate will be evaluated for mechanical fracture and volume swell requirements using the test results taken on samples selected by the Project Manager.

Results are acceptable if the average of all tests is within the specified limits and not more than one test out of any five consecutive tests is outside these limits.

Do not begin plant mix operations until stockpiled aggregates meet these requirements.

- 2. Gradation Requirements.** Plant mix pavement is evaluated for gradation requirements on a lot-by-lot basis. Acceptance is made under Subsection 105.03.2

401.03.4 Preparation of Aggregate.

- A. General.** Have enough material stockpiled for at least one day of plant mix operations.

Do not charge the mixing plant with aggregates directly from crushing or screening plants or a combination of these plants.

Proportion and uniformly blend blending material (not mineral filler), when required, with the aggregate.

- B. Batch and Continuous Flow Plants.** Dry and heat aggregates in the dryer within the mix design temperature range.

The aggregate temperature, when introduced into the mixing unit, must not exceed 325 °F (163°C).

Adjust flames for drying and heating to prevent aggregate damage and not leave visible unburned oil or carbon residue on the aggregate.

If the bituminized mixture shows excess moisture, such as foaming on the coarse aggregate, excessive mix slumping in the truck, condensed water dripping from the truck box, bubbles or blisters forming on the surface immediately behind the paver, or any other visual indications, make adjustments to lower the moisture content.

401.03.5 Preparation of Bituminous Mixture.

- A. All Plants.** Store mineral filler or hydrated lime in a separate bin and feed directly into the mixing unit or weigh box. Use a uniform feed rate.

If mineral filler is not weighed with the other aggregates in the weigh box at the mixing plant, determine the mineral filler proportion on a weight basis, measured separately from the other aggregates. After the mineral filler proportions have been determined, the material may be added to the mix by volume or weight measurement.

Mix to produce a homogeneous mixture. Assure all aggregates are thoroughly and uniformly coated with bitumen.

Remove, dispose of, and replace any mix that is damaged by burning, improper mixing, or not meeting specifications at Contractor expense.

Maintain the bituminous mix discharge temperature between the specified lower mixing temperature and the greater of:

1. The upper mix design temperature; or
2. 325 °F (163 °C).

The discharge temperature will be periodically checked and recorded. Maintain a discharge temperature within plus or minus 10 °F (5.5 °C) of the specified temperature.

The average of any three checks must be within the specified limits. Suspend plant operations when mix temperatures exceed these limits.

B. Batch and Continuous Flow Plants.

1. **General.** Measure and convey the hot aggregate into the mixing unit meeting the specified gradation. Introduce the aggregate at a temperature:

- a. Not to exceed 225 °F (107 °C) when cutback liquid asphalt is used;
- b. Not to exceed 325 °F (163 °C) when asphalt cement or slow-curing liquid asphalt is used.

Do not introduce asphalt into the mixing unit at 25 °F (14 °C) or more below the aggregate temperature.

Assure the bituminous mix is within the specified temperature range in the data on "temperature-viscosity", furnished for the bituminous material used.

2. **Mixing Time.** Mix for at least 25 seconds or the time specified by the Project Manager.

Mixing time, in seconds, for continuous flow plants equals "pugmill dead capacity in pounds (kilograms)" divided by "pugmill output in pounds (kilograms) per second".

401.03.6 Surface Conditions, Weather Limitations, and Paving Dates. Do not place bituminous mix when the base surface temperature is less than 30 °F (-1.1 °C); on a wet surface; on an unstable roadbed; or when the Project Manager determines adverse weather conditions prevent the proper handling, finishing, or compacting of the mix.

Complete all sections of plant mix surfacing pavement, to be open to traffic during winter suspension, to the full plan width and thickness, excluding seal coating and open-graded friction course. Complete this work meeting the specifications before the October 15 paving cessation date.

Plant mix surfacing placed after October 15 and before April 15 is at the Contractor's risk and subject to the following conditions.

- The surface temperature to be paved must be at least 35 °F (2 °C), measured by the Project Manager.
- Apply striping within 24 hours after paving is complete on each day's work.
- Produce and place plant mix surfacing meeting all applicable specifications.

If the paving operation causes transverse joints spaced at less than one half mile (805 m), suspend work until the next April 15.

No payment is made for plant mix surfacing or asphalt on progress estimates between October 15 and April 15 for partial width or thickness.

Promptly repair damage to all partial width or thickness of plant mix surfacing used by traffic during this period for any reason including suspension of work due to adverse weather.

Provide all required interim traffic striping and signing on partially completed pavement at Contractor expense.

Failure to promptly make repairs and provide interim striping and signing is cause for the Department to perform or have the work performed and deduct the cost from monies due or that may become due the Contractor.

Payment for partial width or thickness pavement in acceptable condition will be made on the estimates following the end of the period on April 15.

- Make permanent repairs and restore partially completed pavement to the required profile, section, and condition at Contractor expense before placing any remaining lifts.
- This is not a waiver by the Department of any other contract requirement regarding the work sequence or traffic operation.

These requirements do not apply where the Project Manager requests in writing that a portion of the planned width or thickness be placed between October 15 and April 15 of the next year.

401.03.7 Existing Surface Preparation. Perform existing surface preparation meeting Section 204 requirements.

401.03.8 Prime and Tack Coat. Apply prime and tack coat meeting the applicable requirements of Sections 407 and 410 and the Contract.

Apply prime coat as directed before placing the plant mix.

Allow the prime coat to cure at least 24 hours before placing the plant mix unless otherwise approved.

Do not place plant mix on any primed surface containing free moisture, as determined by the Project Manager.

Apply tack coat on existing pavement to be overlaid and between lifts when plant mix pavement is constructed in multiple lifts.

401.03.9 Protection of Traffic and Roadway Structures.

A. Traffic Protection. Place traffic control devices meeting Section 618 requirements, and the approved traffic control plan.

At the end of each day's work, and when not in use, park all equipment at least 30 feet (9.2 m) from the outside edges of the traveled lane.

B. Protection of Roadway Structures. Protect roadway structures meeting Subsection 410.03.9 requirements.

401.03.10 Spreading and Finishing. Place and spread the mix to the widest practical width on the approved surface. Place shoulder widening material with approved equipment.

Transport and place the bituminous mix with the least possible segregation. Remove and replace segregated pavement areas behind the paver with specification material before initial rolling begins. Correct all segregated areas at Contractor expense.

Place plant mix surfacing in compacted lifts not exceeding 0.20 feet (60 mm) thick; plant mix bituminous base in compacted lifts not exceeding 0.35 feet (110 mm); and plant mix base riding course not exceeding 0.25 feet (75 mm) thick.

The Project Manager will establish horizontal alignment controls for spreading each lift.

Set a string line using the alignment control to establish one edge of the first lane of each surfacing lift. Remove all string-line used for the final lift after use.

On small or irregular areas, approaches, turnouts, around manholes, inlets, walls, and on other areas not readily accessible to a paver, plant mix material may be spread to the specified thickness by special pavers or other approved methods. Compact these areas as directed.

Place plant mix pavement at bridge ends using wire line grade control meeting the applicable requirements of Subsection 411.03.5.

Non-Interstate two lane plant mix pavements may be opened to traffic or to haul units when the mat is compacted and cooled.

Four lane routes may be opened to traffic and haul units when the mat is compacted and the surface cools to 140 °F (60 °C).

401.03.11 Constructing Joints. Continuously place each lift and provide at least a 6-inch (150 mm) offset between longitudinal joints in successive lifts. Offset transverse joints in successive lifts by at least 6 feet (1.8 m).

Correct joints not meeting the surface tolerance requirements to Subsection 401.03.14 requirements.

Uniformly coat the exposed face of all joints, excluding those formed by echelon paving, with SS-1 emulsified asphalt or other approved bitumen just before placing the abutting course.

Construct longitudinal joints in the top lift of plant mix at the centerline or lane line. If these locations are not practical, construct the joint outside the wheel paths.

Construct a vertical transverse joint the full lift depth if the mix cools below 175 °F (80 °C) before placing additional mix. Remove loose material, brush the joint face with asphalt, and compact the fresh mix against the joint face when paving is resumed.

Bevel the paving lift ends on roadways under traffic at a 20:1 ratio. When paving of the lift resumes, construct transverse joints.

When the compacted thickness exceeds 3/4-inch (19 mm), taper longitudinal joints with a 5:1 slope or flatter. Do not permit an exposed longitudinal joint length to exceed one day's paving run. Compact the joint to a minimum 95 percent of Marshall density.

Sign the new pavement end at the close of work each day meeting the Traffic Control Plan and Contract.

Construct joints at bridge ends or other rigid structures after the existing base is prepared and compacted. Apply a coat of SS-1 emulsified asphalt to portions of structures abutting the plant mix pavement.

401.03.12 Compaction, Compaction Control Testing, and Acceptance Testing.

A. Compaction. Once the plant mix is spread, struck off, and surface irregularities are corrected, compact the plant mix to at least 95 percent of the established target density. Compact and finish without displacing, over-compacting, cracking, or shoving.

Complete compaction rolling before the mat temperature falls below 175 °F (80 °C). Compaction rolling after the temperature is below 175 °F (80 °C) is cause to suspend paving operations. Compaction rolling is rolling in the vibratory mode. The Project Manager may increase the minimum 175 °F (80 °C) temperature when compaction rolling damages the new pavement.

Begin finish rolling immediately after compaction rolling and continue until roller marks are eliminated. Complete finish rolling the same day the mix is placed.

Correct any pavement displaced due to roller direction changes or other causes before final compaction.

Remove and replace any mix that is segregated, loose and broken, mixed with dirt, or is defective with fresh hot mix and compact at Contractor expense.

- B. Leveling, Patching, and Thin Lifts.** Subsection 401.03.12(A) does not apply to initial plant mix lifts used for leveling ruts, sags, or other existing surface defects that are less than 0.10 foot (30 mm) thick.

Perform initial rolling using oscillating-axle pneumatic-tired rollers with a minimum 20 ton (18 mt) operating weight and not less than 250 pounds (113.5 kg) per inch (25 mm) width of tire tread. Perform finish rolling meeting the requirements of Subsection 401.03.12(A). Compact the material to the density specified by the Project Manager.

- C. Compaction Control Testing.** The Contractor may perform density tests to control compaction or have the Department perform the tests as follows:

At Contractor request, the Project Manager will take nuclear density readings during compaction. The test locations and time may be requested by the Contractor but must not conflict with acceptance testing.

The Project Manager will provide the results, including any core density corrections, in a weight per cubic foot (weight per cubic meter) and a target density. The Contractor is to interpret these results and decide what, if any, action is required.

The tests and information furnished by the Project Manager does not relieve the Contractor's responsibility for meeting the specified density or obligation for any price reductions that may be applied under the acceptance provisions.

- D. Acceptance Testing.** The pavement density is determined at randomly selected locations after all rolling is complete and before the roadway is open to traffic. The density is determined using MT-212 and MT-313.

The density is divided by the Field Marshall Target density currently in effect to arrive at a percentage. The Field Marshall Target density for the mix is established by the Project Manager from the test results using MT-311.

The Project Manager will select the test locations using random selection based on the tons (metric tons) of mix placed. Areas within 1 foot (305 mm) of a free edge or where the nominal thickness is less than 0.10 foot (30 mm) are excluded from testing.

The approximate mix quantity represented by each test is 600 tons (540 mt). Additional tests may be made at the Project Manager's discretion. The quantity represented by 5 tests or approximately 3,000 tons (2700 mt) of mix will constitute a lot whenever production schedules and material continuity permit. The Project Manager will establish a lot represented by 3 to 7 consecutive random samples when there are short production runs, significant material changes, or other unusual characteristics of the work.

- E. Acceptance.** Plant mix surfacing is evaluated for density on a lot-by-lot basis under Subsection 105.03.2, except as noted in Subsection 401.03.12(B).

401.03.13 Pavement Repair. Cut out the defective pavement to a minimum 1-inch (25 mm) depth. Clean the sides and bottom of the hole and apply an approved bitumen to the surfaces. Fill the hole with fresh mix, level, and compact to the specified density and surface smoothness.

401.03.14 Surface Tolerances. Finish the surface of each final lift to the specified grade and cross section. The following values specify the maximum allowable variance and divergence from the mean constructed grade:

Surface	Total Variation	Rate
New Plant Mix Bituminous Surfacing	0.02 foot (6 mm)	0.20%
Plant Mix Overlays (2 or more planned lifts)	0.03 Foot (9 mm)	0.30%
Plant Mix Overlays (less than two planned lifts)	0.03 Foot (9 mm)	No Rate

The rate is applicable only to the longitudinal direction.

New plant mix bituminous surfacing includes the plant mix seal.

The mean constructed grade for each section is the planned grade or a grade parallel to plan grade, acceptable to the Engineer.

Surfaces will be checked for compliance at joints, bridge ends, and other sections where ride characteristics or other evidence indicates surface tolerance is outside the specifications.

Surface smoothness is measured longitudinally in 100 foot (30.5 m) sections at 10 foot (3 m) intervals, and transversely at 4 foot (1.2 m) intervals. Correct out of specification plant mix bituminous surfacing by any method approved by the Engineer, including cold milling at least 0.12 foot (38 mm) deep, the full width of the defect but not less than the paver width and for 50 feet (15.2 m) each side of the defective pavement. Fill the milled area with like material and compact to the specified density.

The corrected pavement and adjoining surface must meet the smoothness specifications.

The Contractor will be notified of sections to be corrected within 3 working days after the surface was placed or the final day of paving. Perform all corrective work at Contractor expense.

Transverse joints in lifts of plant mix surfacing or other lifts to be used by traffic for 15 days or more must not vary more than 3/8-inch (10 mm) from any point on a taut 25 foot (7.6 m) string line placed parallel to centerline. Open-graded friction course and other plant mix seal courses must not vary by more than 3/16-inch (5 mm).

New surfaces will be checked for a minimum of 100 feet (30.5 m) by placing the string line in half-length increments along the roadway in traffic lanes.

Corrected areas including new joints will be checked for meeting the surface tolerances.

401.04 METHOD OF MEASUREMENT.

401.04.1 Plant Mix Pavement. Plant mix pavement is measured by the ton (metric ton) on approved scales after complete mixing of all ingredients. The pay weight includes the bituminous material and any mineral filler or hydrated lime in the mixture.

401.04.2 Bituminous Material. Bituminous material is measured by the U.S. gallon (Liter) or the ton (metric ton), as specified, under Subsection 402.04, excluding anti-stripping additive.

401.04.3 Mineral Filler. Mineral filler is measured by the ton (metric ton) under Subsection 109.01.

401.04.4 Hydrated Lime. Hydrated lime is measured by the ton (metric ton) under Subsection 109.01.

401.04.5 Anti-Stripping Additive. Anti-stripping additive is measured for payment based on invoice prices.

401.05 BASIS OF PAYMENT. Payment for the completed and accepted quantities is made under the following:

<u>Pay Item</u>	<u>Pay Unit</u>
Plant Mix Pavement	Ton (metric ton)
Bituminous Material	Gallon (liter) or Ton (metric ton)
Mineral Filler	Ton (metric ton)
Hydrated Lime	Ton (metric ton)
Anti-stripping Additive	Ton (metric ton)

Payment will not be made for any claim for rejecting any batch or load of mix containing bituminous material varying more than 0.3% from the established percentage in the job mix formula.

Mineral filler or hydrated lime used but not specified in the Contract is paid for at the invoice price per ton (metric ton), delivered to the project, plus 4 dollars per ton (metric ton) for the cost to incorporate it into the bituminous mixture.

Furnish certified copies of invoices to support the prices for mineral filler, hydrated lime, and anti-stripping additives.

Payment at the contract unit price is full compensation for all necessary resources to complete the item of work under the Contract.